FORM PTO-1390
REV. 5-93

US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEYS DOCKET NUMBER
P00,1883

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)
09/701883

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/01616	**01 JUNE 1999**	**04 JUNE 1998**

TITLE OF INVENTION
METHOD FOR THE COMPRESSED CORDLESS COMMUNICATION BETWEEN A BASE STATION AND A PLURALITY OF MOBILE PARTS

APPLICANT(S) FOR DO/EO/US **KLAUS-DIETER PILLEKAMP**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2)) - drawings attached.
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2) - drawings attached.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report).**
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ Amendment "A" Prior to Action.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☒ A change of address letter attached to the Declaration.
16. ☒ Other items or information:
    a. ☒ Request for Approval of Drawing Additions to Fig. 2
    b. ☒ Appointment of Associate Power of Attorney
    c. ☒ EXPRESS MAIL #EL655299360US dated December 4, 2000

428 Rec'd PCT/PTO 04 DEC 2000

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/701883	PCT/DE99/01616	P00,1883

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $860.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) .. $690.00		
No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) $710.00		
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $1000.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate	
Total Claims	17	- 20 =	0	X $ 18.00	$
Independent Claims	03	- 3 =	0	X $ 80.00	$
Multiple Dependent Claims				$270.00+	$
			TOTAL OF ABOVE CALCULATIONS =		$ 860.00
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$
			SUBTOTAL =		$ 860.00
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+	$
			TOTAL NATIONAL FEE =		$ 860.00
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property				+	
			TOTAL FEES ENCLOSED =		$ 860.00
				Amount to be refunded	$
				charged	$

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **501519**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SCHIFF HARDIN & WAITE
PATENT DEPARTMENT
6600 Sears Tower
233 South Wacker Drive
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Mark Bergner
SIGNATURE

Mark Bergner
NAME

45,877
Registration Number

BOX PCT
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

APPLICANT(S):	KLAUS-DIETER PILLEKAMP
ATTORNEY DOCKET NO.:	P00,1883
INTERNATIONAL APPLICATION NO:	PCT/DE99/01616
INTERNATIONAL FILING DATE:	01 JUNE 1999
INVENTION:	METHOD FOR THE COMPRESSED CORDLESS COMMUNICATION BETWEEN A BASE STATION AND A PLURALITY OF MOBILE PARTS

Assistant Commissioner for Patents,
Washington D.C. 20231

AMENDMENT A PRIOR TO ACTION

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination on the United States Examination Phase.

IN THE SPECIFICATION:

On page 1:

replace lines 1-2, with

--SPECIFICATION

TITLE

METHOD FOR THE COMPRESSED CORDLESS COMMUNICATION BETWEEN A BASE STATION AND A PLURALITY OF MOBILE PARTS

BACKGROUND OF THE INVENTION

Field of the Invention--;

in line 5, replace "K*<K" with –K*, which is < K,--;

above line 7, insert

--Description of the Related Art--;

in line 8, replace "represents" with –is--;

in line 13, replace "thereby available onto" with –available to--;

in line 19, after "GSM", insert –(Global System for Mobile Communications)–;

in line 20, cancel "(Global System for Mobile Communications)"; and

in line 26, replace "whereby" with –in which–.

On page 2:

in line 1, replace ". As a result thereof," with –, resulting in optimum utilization of–;

in lines 2-3, cancel "can be optimally utilized";

in line 5, replace "hitherto run afoul thereof that" with –previously been problematic because–;

in line 6, replace "wherein" with –in which–;

in line 8, cancel "the schematic illustration in"

above line 12, insert

--SUMMARY OF THE INVENTION–;

in line 12, replace "propose" with –provide–;

in line 14, replace "wherein" with –in which–;

replace lines 15-18 with

-- This object is achieved by a method for the compressed cordless communication between a base station and a plurality K of mobile parts via a plurality of K*, which is less than K, physical radio channels, comprising the steps of: acquiring pause sections in respective transmission data in the base station and the mobile parts; storing the transmission data in a transmission data memory in the base station and a transmission data memory in the mobile parts; storing appertaining the transmission data and transmission pause time reference information in a transmission time reference memory in the base station and in the mobile parts; communicating the time reference information from the mobile parts to the base station; determining transmission time intervals of the base station and of the mobile parts with a controller implemented in the base station; and transmitting the transmission time intervals from the base station to the respective mobile parts allocated to the individual base stations.

The object is also achieved by a base station for a compressed cordless communication with a plurality K of base stations via a plurality K*, which is less than K of physical radio channels, comprising: a data input; a data pause acquisition mechanism for acquiring data pauses in transmission data from the data input; a transmission data memory for storing the transmission data; a transmission time reference memory for storing transmission data and transmission pause time reference information; a modulator-concentrator for compressing the transmission data onto K* physical radio channels; a transmitter for transmitting the compressed transmission data; a receiver for receiving reception data; a demodulator-expander for expanding the received data onto K logical communication channels; a reception data memory for storing the reception data; a reception time reference memory for storing time reference information belonging to the reception data; a data output for outputting the reception data; a controller for controlling transmission time intervals of the transmitter and of the mobile parts and for compiling the reception data stored in the reception data memory based on the time reference information stored in the reception time reference memory such that an original data and pause sequence of the data is restored for an output of data at the data output.

The object is also achieved by a mobile part for a compressed cordless communication with a base station, comprising: a data input; a data pause acquisition mechanism for acquiring data pauses in transmission data from the data input; a transmission data memory for storing the transmission data; a transmission time reference memory for storing the appertaining transmission data and transmission pause time information; a transmitter; a receiver for receiving data; a reception data memory for storing the received data; a reception time reference memory time reference information belonging to the reception data; a data output for outputting the reception data; a controller for controlling the transmitter for a transmission of transmission data dependent on transmission time intervals received from the base station and for compiling the reception data stored in the reception data memory based on time reference information stored in the reception time reference memory such that an original data and pause sequence of the data is restored, and for an output of the data at the data output.--; and

cancel lines 19-28.

On page 3:

cancel lines 1-6;

in line 16, replace “respectively other” with –other respective--;

in line 18, replace “ration” with –ratio--;

in line 21, after “part”, insert --,--;

in line 22, cancel “thereby”, and after “arises”, insert –from this--;

in line 24, after “as”, insert –a--; and

in line 25, after “between”, insert –a--.

On page 4:

in line 4, cancel “, respectively,”;

in line 5, replace “whereby” with –in which--; and

in line 23, replace “control means” with –controller--.

On page 5:

in line 1, after “When”, insert –a--;

above line 4, insert

--BRIEF DESCRIPTION OF THE DRAWINGS --;

in line 5, replace “, wherein” with --.--;

in line 10, replace “Figure 3 an illustration” with –Figures 3A & 3B are graphic illustrations--

above line 12, insert

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

in line 13, cancel “Let it be”;

replace lines 14-15 with –A mobile part here is not necessarily defined as a mobile telephone or car telephone—a mobile part as defined here means any communication terminal--;

in line 18, cancel “, for example,”;

in line 21, replace “means” with –mechanism--;

in line 23, replace "corresponds [sic]" with –correspond--, and after "example", insert --,--; and

in line 26, replace "therein by a control means" with –within by a controller--.

On page 6:

in line 1, replace "transmission means" with –transmitter--, and after "concentrator", insert --*--;

in line 3, replace "control means" with –controller--;

in line 7, replace "reception means" with –receiver--;

in line 11, replace "control means" with –controller--;

in line 16, after "subscriber", insert --,--;

in line 17, replace "means 20. The" with –mechanism 20 at which the--;

in line 23, replace "amounts to" with –is--;

in line 24, replace "= 4ms" with –(4 ms total)--; and

in line 29, replace "control means" with –controller--.

On page 7:

in line 2, replace "transmission means" with –transmitter--, and cancel "thereby";

in line 4, after "a", insert –connected--;

replace line 5 with –loss are thus also prevented given a user of a mobile part for--;

in line 6, replace "means" with –mechanism--;

in line 9, after "example", insert --,--;

in line 12, replace "reception means" with –receiver--;

in line 15, after "i.e.", insert --,--;

in line 16, replace "control means" with –controller--;

in line 17, replace "reception means" with –receiver--, and replace "control means" with –controller--; and

in line 21, replace "control means" with –controller--.

On page 8:

in line 2, replace "control means" with –controller--;

in line 4, replace "Given what is referred to as a joint detection" with –For a "joint detection"--;

in line 15, replace "derives wherein" with –occurs in which--; and

in line 20, replace "so large" with –large enough-, and after "compensated", insert –for—.

On page 9, in line 28, replace "whereby" with –in which--.

On page 10:

in line 4, replace "Given" with –For--;

in line 6, replace "whereby" with –in which--;

in line 11, replace "proposes" with –provides--;

in line 13, replace "K*<K" with –K*, which is <K,--, and replace "whereby" with –in which--; and

below line 14, insert

-- The above-described method and devices are illustrative of the principles of the present invention. Numerous modifications and adaptations thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.--.

IN THE CLAIMS:

On page 11:

replace line 1 with –WHAT IS CLAIMED IS:--;

Please amend the following claims 1-17.

1. (Amended) A method [Method] for the compressed cordless communication between a base station and a plurality K of mobile parts via a plurality of K*, which is less than [<] K, physical radio channels, comprising the [method] steps of:

[-- acquisition of] acquiring pause sections in [the] respective transmission data in said [the] base station and said [the] mobile parts;

[--] storing said [the] transmission data in a transmission data memory [(3, 15)] in said [the] base station and a transmission data memory in said [the] mobile parts;

[--] storing [the] appertaining said transmission data and transmission pause time reference information in a transmission time reference memory [(6, 17)] in said [the] base station and in said [the] mobile parts;

[--] communicating said [the] time reference information from said [the] mobile parts to said [the] base station;

[--] determining transmission time intervals of said [the] base station and of said [the] mobile parts with a controller [control means (5)] implemented in said [the] base station; and

[--] transmitting said [the] transmission time intervals from said [the] base station to said [the] respective mobile parts allocated to said [the] individual base stations.

2. (Amended) The method [Method] according to claim 1, wherein said [characterized in that the] time reference information is communicated [transmitted] from said [the] mobile parts to said [the] base station in a control information field together with said [the] transmission data.

3. (Amended) The method [Method] according to claim 1, wherein said [or claim 2, characterized in that the] transmission time intervals are communicated from said [the] base station to [the] respective said mobile parts in a control information field together with said [the] transmission data.

4. (Amended) The method [Method] according to claim 1, wherein communication between said base station and said mobile parts takes place using [one of the claims 1 through 3, characterized in that] a combined TDMA/CDMA method [is applied as radio transmission method between base station and mobile parts].

5. (Amended) The method [Method] according to claim 1, further comprising the step of selecting a [one of the claims 1 through 4, characterized in that the] ratio of said [the] plurality of physical radio channels to a [the] plurality of logical transmission channels K*/K [is selected] dependent on an average data-to-pause ratio of [the] communication between said base station and said mobile parts.

6. (Amended) The method [Method] according to claim 5, wherein said [characterized in that the] ratio [of the plurality of physical radio channels to the plurality of logical data channels amounts to] is 1/2.

7. (Amended) The method [Method] according to claim 1, further comprising the step of communicating at regular intervals by said base station, [one of the claims 1 through 6, characterized in that,] independently of said [the] data transmission, [the base station communicates] a control signal to all said mobile parts [at regular intervals] for updating [the] reception data memory [(14)] and [the] reception time information memory [(16)] of a [the] respective said mobile part.

8. (Amended) The method [Method] according to claim 1, wherein said [one of the claims 1 through 7, characterized in that the] transmission data are stored in blocks corresponding to a fixed transmission data length.

9. (Amended) The method [Method] according to claim 8, wherein said fixed transmission data length is [characterized in that the block length corresponds to] the frame length of a TDMA frame or a multiple thereof.

10. (Amended) The method [Method] according to claim 8, wherein said [or 9, characterized in that the size of said [the] transmission data memory [memories (3, 15)] and reception data memory [memories (4, 14) is] are sized to be a whole multiple of said [the] block size and is selected according to a maximally allowed delay time.

11. (Amended) The method [Method] according to claim 1, further comprising the step of controlling: [one of the claims 1 through 10, characterized in that the] data output from one of said [a] mobile parts [part] or said [the] base station, to a user or [, respectively,] a connected communication network [is] controlled such that a [the] signal running time influenced by [the] data storage at a [the] transmission and a reception side is always constant for all transmission channels.

12. (Amended) The method [Method] according to claim 1, further comprising the steps of: [one of the claims 1 through 11, characterized in that]

storing transmission pauses [are stored] in said [the] time reference memories [(6, 7, 16, 17)] of said [the] base station and of said [the] mobile parts in a [the] form of whole multiples of a transmission data block length; and [in that,]

reinserting said transmission pauses, upon output of [the] data from [a] one of said mobile parts [part] to a user or, respectively, to said [the] base station to a connected communication network, [the pauses are reinserted] into a [the] data stream in proper time dependent on said [the] time reference information stored in said [the] reception time reference memory [(7, 16)] in order to restore the original data and [/] pause sequence.

13. (Amended) The method [Method] according to claim 1, further comprising the step of [one of the claims 1 through 12, characterized in that the control means (5)] providing an ability by said controller of said [the] base station [assures that] for each mobile telephone to [can] transmit at least once in a time interval that corresponds to [the size of] its transmission data memory size [(15)].

14. (Amended) The method [Method] according to claim 1, further comprising the step of [one of the claims 1 through 13, characterized in that,] informing, by said base station, dependent on [the] data stored in said [the] transmission data memory [memories (3, 15)] of said [the] base station and of said [the] mobile parts, [the base station informs] respective mobile parts whether said [the] mobile part sends [and/] or receives data for a specific time duration.

15. (Amended) A base station for a compressed cordless communication with a plurality K of base stations via a plurality K*, which is less than [<] K_s of physical radio channels, comprising:

[--] a data input;

[--] a data pause acquisition mechanism [means (1)] for acquiring data pauses in [the] transmission data from said data input;

[--] a transmission data memory [(3)] for storing said [the] transmission data;

[--] a transmission time reference memory [(6)] for storing transmission data and transmission pause time reference information;

[--] a modulator- [/] concentrator [(8)] for compressing said [the] transmission data onto K* physical radio channels;

[--] a transmitter for transmitting said compressed transmission data [transmission means (10)];

[--] a receiver [reception means (11)] for receiving reception data;

[--] a demodulator- [/] expander [(9)] for expanding said [the] received data onto K logical communication channels;

[--] a reception data memory [(4)] for storing said [the] reception data;

[--] a reception time reference memory [(7)] for storing [the] time reference information belonging to said reception [the received] data;

[--] a data output for outputting said reception data;

[--] a controller [control means (5)] for controlling [the] transmission time intervals of said transmitter [the transmission means (10)] and of said [the] mobile parts and for compiling said [the] reception data stored in said [the] reception data memory [(4) on the basis of the] based on said time reference information stored in

said [the] reception time reference memory [(7)] such that an [the] original data and [/] pause sequence of said [the] data is restored for an [the] output of [the] data at said [the] data output.

16. (Amended) A base [Base] station according to claim 15, wherein said [characterized in that the] data output is connected to another communication network.

17. (Amended) A mobile [Mobile] part for a compressed cordless communication with a base station, comprising:

[--] a data input;

[--] a data pause acquisition mechanism [means (20)] for acquiring data pauses in transmission data from said data input;

[--] a transmission data memory [(15)] for storing said [the] transmission data;

[--] a transmission time reference memory [(17)] for storing the appertaining transmission data and transmission pause time information;

[--] a transmitter [transmission means (13)];

[--] a receiver [reception means (12)] for receiving data;

[--] a reception data memory [(14)] for storing said received [the reception] data;

[--] a reception time reference memory [(16) for storing the] time reference information belonging to said reception [the received] data;

[--] a data output for outputting said reception data;

[--] a controller [control means (18)] for controlling said transmitter [the transmission time means (13)] for a [the] transmission of transmission data dependent on [the] transmission time intervals received from said [the] base station and for compiling said [the] reception data stored in said [the] reception data memory [(14) on the basis of the] based on time reference information stored in said [the] reception time reference memory [(16)] such that an [the] original data and [/] pause sequence of said [the] data is restored, and for an [the] output of said [the] data at said [the] data output.

IN THE ABSTRACT:

On page 15:

replace lines 2-20 with

-- A method and supporting base station and mobile devices are provided for communication between a base station and a plurality K of mobile parts via a plurality of K*, which is less than K, physical radio channels are provided. This is accomplished by acquiring pause sections in transmission data in the base station and mobile parts, storing this information with the transmission data in respective memories of the devices, and communicating this information between the devices. The transmission data, with the pauses, is reconstructed at the receiving end.--.

REMARKS

The present Amendment revises the specification and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. All of the changes are editorial and applicant believes no new matter is added thereby. The amendment of claims is not intended to be a surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

Submitted by,

(Reg. No. 45,877)

Mark Bergner
Schiff Hardin & Waite
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6600 Sears Tower
233 South Wacker Drive
Chicago, Illinois 60606-6473
(312) 258-5779
Attorneys for Applicant

BOX PCT
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

APPLICANT(S):	KLAUS-DIETER PILLEKAMP
ATTORNEY DOCKET NO.:	P00,1883
INTERNATIONAL APPLICATION NO:	PCT/DE99/01616
INTERNATIONAL FILING DATE:	01 JUNE 1999
INVENTION:	METHOD FOR THE COMPRESSED CORDLESS COMMUNICATION BETWEEN A BASE STATION AND A PLURALITY OF MOBILE PARTS

Assistant Commissioner for Patents,
Washington D.C. 20231

AMENDMENT A PRIOR TO ACTION

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination on the United States Examination Phase.

IN THE SPECIFICATION:

On page 1:

replace lines 1-2, with

--SPECIFICATION

TITLE

METHOD FOR THE COMPRESSED CORDLESS COMMUNICATION BETWEEN A BASE STATION AND A PLURALITY OF MOBILE PARTS

BACKGROUND OF THE INVENTION

Field of the Invention--;

in line 5, replace "K*<K" with –K*, which is < K,--;

above line 7, insert

--Description of the Related Art--;

in line 8, replace "represents" with –is--;

in line 13, replace "thereby available onto" with –available to--;

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Assistant Commissioner for Patents,
Washington, D.C. 20231

REQUEST FOR APPROVAL OF DRAWING MODIFICATIONS

Sir:

Enclosed is 1sheet of drawings, Figure 2, showing in red, the addition of labels to the elements depicted therein. Approval of the additions is respectfully requested.

Submitted by,

Mark Bergner (Reg. No. 45,877)

Mark Bergner
SCHIFF HARDIN & WAITE
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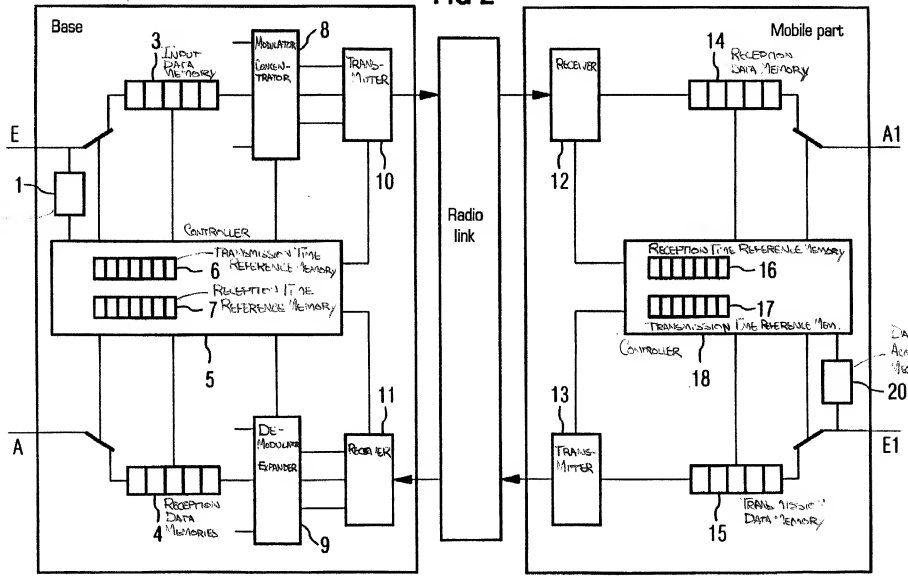
Attorney for Applicant(s)

FIG 2



2/4

METHOD FOR THE COMPRESSED CORDLESS COMMUNICATION BETWEEN A BASE STATION AND A PLURALITY OF MOBILE PARTS

The invention is directed to a method for the compressed cordless communication between a base station and a plurality K of mobile parts via a plurality of K*<K physical radio channels and is also directed to a base station and to a mobile part for a compressed cordless communication.

Due to the great increase in cordless communication via radio, the radio frequency spectrum represents a tight, non-expandable resource and should be utilized as efficiently as possible. In current analog and digital mobile radiotelephone systems, a physical radio channel between the base station and a mobile part is permanently allocated for the duration of a call within a communication cell. Three methods are fundamentally known for dividing the transmission bandwidth that is thereby available onto the individual subscribers or, respectively, mobile parts. In TDMA (**T**ime **D**ivision **M**ultiple **A**ccess), the data of different subscribers are transmitted in time-division multiplex in different time slots. In FDMA (**F**requency **D**ivision **M**ultiple **A**ccess) methods, subscriber are divided onto different frequency bands; and, in CDMA (**C**ode **D**ivision **M**ultiple **A**ccess) methods, the data of different subscribers are encoded with different codes. Combinations of two of these methods are often employed in practice. For example, the GSM mobile telephone standard (Global System for Mobile Communications) employs a combination of TDMA and FDMA. A combination of TDMA and CDMA is under discussion for future mobile communication standards.

A certain percentage of a telephone call is composed of pauses in speech. Great fluctuations of the transmission data rate also occur in data communication. The method of statistical multiplexing is known in the asynchronous transfer mode (ATM) in fixed-network communication, whereby the transmission data of a great number of logical communication connections are divided into data blocks and are transmitted by blocks in time-division multiplex statistically distributed onto a lower

number of physical communication channels. As a result thereof, transmission capacity and memory capacity as well (for example, of a call answering unit) can be optimally utilized.

In TDMA radio transmission systems, the use of statistical multiplexing has hitherto run afoul thereof that, in contrast to fixed-network connections, it is not a matter of a point-to-point connection wherein all information about the data to be transmitted are present at both end points. The link from the base station to the mobile parts is a point-to-multipoint connection (see the schematic illustration in Figure 1). Conversely, the transmission path from the mobile parts to the base station is a multipoint-to-point connection. Given this configuration, only the base station has the information needed for the setup of a statistically multiplexed connection.

It is therefore an object of the invention to propose a method for the cordless communication between a base station and a plurality of mobile parts wherein the available transmission bandwidth is utilized as efficiently as possible.

This object is achieved by the method for compressed cordless communication defined in claim 1 as well as by the base station defined in claim 15 and the mobile part defined in claim 17. Advantageous developments of the invention are described in the subclaims.

The inventive method for compressed cordless communication between a base station and a plurality K of mobile parts via K*<K physical radio channels comprises the following method steps:

-- acquisition of pause sections in the respective transmission data in the base station and the mobile parts;

-- storing the transmission data in a transmission data memory (3, 15) in the base station and in the mobile parts;

-- storing the appertaining transmission data and transmission pause time reference information in a transmission time reference memory (6, 17) in the base station and in the mobile parts;

-- communicating the time reference information from the mobile parts to the base station;

-- determining transmission time intervals of the base station and of the mobile parts with a control means (5) implemented in the base station;

-- transmitting the transmission time intervals from the base station to the respective mobile parts allocated to the individual base stations.

In the inventive method, the compression or concentrator function for both transmission directions is controlled proceeding from the base station. An additional exchange of information between the base station and the mobile parts is required for this purpose. Each mobile part informs the base station of the time reference information of the respective transmission data of the mobile part, whereas the base station that controls the time execution of the communication in both directions communicates the respective transmission time intervals to the mobile parts. The base station thus has the information about transmission times and transmission pauses of all K mobile parts and can use the transmission pauses to transmit the data of respectively other connections. It is thus possible to maintain a plurality K of logical connections via a smaller plurality K* of physical radio channels. The degree of compression is dependent on the average data-to-pause ration.

The time reference information from the mobile part to the base station and, conversely, the information about the transmission time intervals from the base station to the various mobile parts are preferably transmitted in a control information field together with the transmission data. The "overhead" that thereby arises is slight compared to the saving of transmission bandwidth due to the compression.

Preferably, a combined TDMA/CDMA method can be applied as radio transmission method between base station and mobile part. The invention, however, is not limited to such a method but can also be utilized in other digital radio transmission methods.

Independently of the data transmission, the base station preferably communicates a control signal for updating the reception data memory of the mobile

part to all mobile parts at regular intervals. For example, this can ensue every four TDMA time frames.

The transmission data are stored in the transmission data memory of the base or, respectively, of the mobile parts, preferably in blocks corresponding to a fixed transmission duration, whereby the duration advantageously corresponds to the length of a TDMA frame or a multiple thereof. The size of the transmission data and reception data memory is preferably a whole multiple of this block size and is selected corresponding to the maximally allowed delay time, for example 48 ms for voice communication.

In order to assure a good-quality voice transmission, the data output from the base station to a connected communication network or from the mobile part to a user is controlled such that the transmission running time arising due to the intermediate data storage at the transmission and reception side is always constant for all channels.

The transmission pauses are stored in the time reference memories of the base station and of the mobile parts, preferably in the form of whole multiples of a transmission data block length. Upon output of the data from a mobile part to a user or, respectively, the base station to a connected communication network, the pauses are reinserted into the data stream in proper time dependent on the time reference information stored in the reception time reference memory, so that the original data/pause sequence is restored.

According to a preferred exemplary embodiment of the invention, the control means of the base station assures that each mobile part can transmit at least once in a time interval that corresponds to its transmission data memory length. It is thus assured that a data outage does not occur.

According to another preferred exemplary embodiment, the base station informs the respective mobile parts -- dependent on the data stored in the transmission data memories of the base station and of the mobile parts -- whether the mobile part transmits and/or receives for a specific time duration or executes none of these

functions. When transmission part and/or reception part of the mobile part can be turned off for a specific plurality of time slots, then power can be saved at the mobile part.

The invention is explained below on the basis of preferred exemplary embodiments with reference to the accompanying drawings, wherein

Figure 1 is a schematic illustration of the cordless communication between a base station and a plurality of mobile parts;

Figure 2 is a function block diagram of an inventive base station and an inventive mobile part;

Figure 3 an illustration of the functioning or a preferred exemplary embodiment of the inventive method.

An exemplary embodiment of an inventive base station and of an inventive mobile part are explained below with reference to Figure 2. Let it be pointed out that mobile part does not necessarily mean a mobile telephone or car telephone. Mobile part is to understood as meaning any communication terminal device that forms a multipoint-to-point connection with the base station.

The base station shown at the left in Figure 2 is explained first. Transmission data such as, for example, voice data or data for the data communication proceed to the base station from a data input E that, for example, is connected to a telephone fixed network or a mobile radiotelephone network of a different operator or the like. A data/pause acquisition means 1 acquires data pauses in the input data. The input data are subsequently intermediately stored in the input data memory 3 in blocks that corresponds [sic] to a fixed transmission time, for example the frame length of a TDMA frame. The information about the chronological succession of data and pauses is stored in a transmission time reference memory 6 in units of block lengths, being stored therein by a control means 5. One respective transmission data memory 3 and one respective transmission time reference memory 6 is present per K data inputs. On the basis of the current content of the transmission time reference memory 6, the control logic determines the sequence with which the K input channels are conducted

to the transmission means 10 with the assistance of the modulator/concentrator and transmitted via the radio link. The base station can simultaneously set up a maximum of K* physical radio channels. Before sending the data, the control means 5 attaches additional information to the data packet as to when the respectively receiving mobile part is allowed to transmit next.

The data transmitted via the radio link in K* physical channels are received by a reception means 12 of the mobile part and intermediately stored in a reception data memory 14. The time reference information communicated from the base station and belonging to the received data is stored in the reception time reference memory 16. Dependent on the time reference information intermediately stored in the memory 14, the control means 18 of the mobile part recombines the reception data intermediately stored in the memory 14 into the original transmission data with the original data/pause ratio and outputs these at the output A1, a demodulator and a loudspeaker for audio output, for example, being connected to the latter.

The voice data produced, for example, by a subscriber proceed via the data input E1 of the mobile part to the data/pause acquisition means 20. The data pauses are acquired thereat as in the base station, and the appertaining time reference information are stored in units of data blocks in the transmission time reference memory 17 of the mobile part. The transmission data themselves are stored in the transmission data memory 15 of the mobile part.

The size of a data block to be stored meaningfully derives from the TDMA time frame structure. When, for example, the TDMA frame length amounts to eight time slots of 0.5 ms each = 4 ms, then a data block to be stored should not be smaller than 4 ms or a multiple thereof. From, for example, a maximally permitted delay time of 48 ms given voice communication and the block length of 8 ms, the maximum size of the transmission memory and reception memory derives as six blocks each.

Using the transmission time interval information transmitted from the base station together with the transmission data, the control means 18 of the mobile part

controls the transmission time intervals of the data stored in the memory 15 with the transmission means 13. The base station must thereby assure that each mobile part is allowed to transmit at least once in a time interval that corresponds to the transmission data memory size 15. An overflow of the transmission data memory 15 and a data loss connected therewith are thus also assured [sic!!] given a user of a mobile part for which the data/pause acquisition means 20 cannot identify any data pauses.

Moreover, the base station must assure that mobile parts that do not comprise any current transmission data in their transmission data memory 15 are also regularly addressed, for example every four time slots, and the status of their transmission memory 15 is thus updated.

The data sent from the mobile part proceed via the radio link to the reception means 11 of the base station and are subsequently demodulated by a demodulator/expander 9 and expanded onto K channels and intermediately stored in K reception data memories 4. The time reference information transmitted by the mobile part together with the transmission data, i.e. the content of the transmission time reference memory 17 of the mobile part, is communicated to the control means 5 by the reception means 11 of the base station. The control means 5 of the base station thus "knows" the content of all transmission time reference memories 6 of the base station and of the transmission time reference memories 17 of all mobile parts and thus has information about all required transmission times and transmission pauses of the K logical communication channels. The control means 5 can thus optimally utilize the limited resources of the physical radio channels K*. The selection of the ratio of K* to K is determined by the average data-to-pause ratio of the communication system. Given a usual pause part of about 2/3 in the transmission data, a compression ratio of K/K*=2 is realistic.

The reception time reference memory 7 belonging to a mobile part is updated in the base station with the time reference data communicated from the transmission time reference memory 17 of the mobile part. The data stored in the reception data memory 4 can thus be output in turn at the data output A, for example

to a telephone fixed network, with the original data/pause sequence controlled by the control means 5.

The transmission method can, for example, employ a combined TDMA/CDMA structure. Given what is referred to as a joint detection CDMA, a TDMA structure with, for example, eight time slots per frame can be employed. A plurality of data packets, for example up to eight, can be simultaneously sent within each time slot. The individual data packets are spread and transmitted via the same frequency band with different codes. The receiver in turn separates the individual data packets with the assistance of the spread codes that are known at the receiver. In the practical application, a spread code is allocated to each mobile part. When K=16 mobile telephones with eight different codes are allocated to a base station, then it is possible that all eight mobile parts simultaneously set up, for example, a voice connection. The permitted plurality of codes per transmitted burst, however, only amounts to K*=8. The data can no longer be separated given more codes simultaneously. An operating condition thus derives wherein only K*=8 physical duplex radio channels are available to K=16 logical connections. Due to the inventive compression method, this is possible given an average ratio of data to pause of approximately 1:3 in each direction, so that half of the transmission capacity can be saved. Since the ratio of 1:3 is a statistical average, however, the data memories (3, 4, 14, 15) must be so large that fluctuations of the distribution can be compensated. As described above, the size of the data memory is limited by the maximally permitted delay time that, for example, still allows an undisturbed voice communication.

The following Table describes an example of the function execution of the inventive communication method with a plurality of 16 mobile parts over a plurality of K*=8 physical radio channels.

Table

Base Station		Mobile Parts
Base station has determined which data packets must be sent next.		
1. Mobile part addresses: 1 through 8 bit from 16. Note: It must be assured that mobile parts that have reported no current transmission data are also regularly addressed, at least every 4 time slots, and their transmission memory status is updated.	→	2. All mobile parts receive the data. The 1 through 8 addressed mobile parts register the addressing.
3. Time position of the data in the time reference memory: 1 through 8 times 4 bits, belonging to the mobile part addresses.	→	4. The 1 through 8 addressed mobile parts update the time reference memory (16).
5. 1 through 8 data packets, belonging to the mobile part addresses	→	6. The data are decoded and stored, the data are deposited in the reception data memory (14).
7. Mobile part enable for the next reception time slot, 1 through 8 bits from 16	→	8. All mobile parts receive the data. The 1 through 8 mobile parts that are allowed to send the next time store this enable.
		All mobile parts that have received the send enable send simultaneously.
10. Base station stores the data packet in the appertaining reception data memory (4)	←	9. Data packet
12. Base updates the appertaining time reference (7). The base station calculates the current transmission sequence on the basis of the occupancy of the time reference.	←	11. Current occupancy of the buffer memory and of the time reference for the next 4 time slots. 4 bits per 1 through 8 mobile parts

A further example for illustrating the functioning of the inventive communication method is described below with reference to Figure 3.

Figure 3 shows the exemplary occupancy of transmission data memories and reception data memories of a communication connection on the basis of an example with K=8 logical connections or, respectively, mobile parts via K*=4 physical radio channels, whereby the communication direction is immaterial.

Each letter (A-H) corresponds to a data packet of a specific length. Unlabeled fields in a data memory correspond to pause blocks. The data blocks that are not in bold face in the reception data memory (right) in the first or second column were not transmitted at the proper time. The transmission ensues earlier because transmission capacity was present. The packets are in turn classified in proper time later with the information from the time reference memory. At time T=6, one can see that the entire data field that was in the transmission data memory (upper left) in time

step T=1 was transmitted into the reception data memory (lower right) at the proper time.

This example applies fundamentally both in the direction from the base station to the mobile part and vice versa. Given the transmission from the base station to the mobile part, the entire transmission data memory for all K=8 logical communication connections is situated in the base, whereby the eight lines of the illustrated reception data memory are divided onto the eight mobile parts (A-H). In the transmission from the mobile parts to the base station, conversely, the transmission data memory (left) is divided onto the individual mobile parts and the reception data memory is situated in the base.

The invention proposes a communication method for compressed cordless communication between a base station and a plurality K of mobile parts via a plurality of K*<K physical radio channels, whereby the available radio transmission bandwidth is efficiently utilized.

Patent Claims

1. Method for the compressed cordless communication between a base station and a plurality K of mobile parts via a plurality of K*<K physical radio channels, comprising the method steps:

-- acquisition of pause sections in the respective transmission data in the base station and the mobile parts;

-- storing the transmission data in a transmission data memory (3, 15) in the base station and in the mobile parts;

-- storing the appertaining transmission data and transmission pause time reference information in a transmission time reference memory (6, 17) in the base station and in the mobile parts;

-- communicating the time reference information from the mobile parts to the base station;

-- determining transmission time intervals of the base station and of the mobile parts with a control means (5) implemented in the base station;

-- transmitting the transmission time intervals from the base station to the respective mobile parts allocated to the individual base stations.

2. Method according to claim 1, characterized in that the time reference information is transmitted from the mobile parts to the base station in a control information field together with the transmission data.

3. Method according to claim 1 or claim 2, characterized in that the transmission time intervals are communicated from the base station to the respective mobile parts in a control information field together with the transmission data.

4. Method according to one of the claims 1 through 3, characterized in that a combined TDMA/CDMA method is applied as radio transmission method between base station and mobile parts.

5. Method according to one of the claims 1 through 4, characterized in that the ratio of the plurality of physical radio channels to the plurality of logical

transmission channels K*/K is selected dependent on an average data-to-pause ratio of the communication between base station and mobile parts.

6. Method according to claim 5, characterized in that the ratio of the plurality of physical radio channels to the plurality of logical data channels amounts to 1/2.

7. Method according to one of the claims 1 through 6, characterized in that, independently of the data transmission, the base station communicates a control signal to all mobile parts at regular intervals for updating the reception data memory (14) and the reception time information memory (16) of the respective mobile part.

8. Method according to one of the claims 1 through 7, characterized in that the transmission data are stored in blocks corresponding to a fixed transmission data length.

9. Method according to claim 8, characterized in that the block length corresponds to the frame length of a TDMA frame or a multiple thereof.

10. Method according to claim 8 or 9, characterized in that the size of the transmission data memories (3, 15) and reception data memories (4, 14) is a whole multiple of the block size and is selected according to a maximally allowed delay time.

11. Method according to one of the claims 1 through 10, characterized in that the data output from a mobile part or the base station to a user or, respectively, a connected communication network is controlled such that the signal running time influenced by the data storage at the transmission and reception side is always constant for all transmission channels.

12. Method according to one of the claims 1 through 11, characterized in that transmission pauses are stored in the time reference memories (6, 7, 16, 17) of the base station and of the mobile parts in the form of whole multiples of a transmission data block length; and in that, upon output of the data from a mobile part to a user or, respectively, the base station to a connected communication network, the pauses are reinserted into the data stream in proper time dependent on the time reference

information stored in the reception time reference memory (7, 16) in order to restore the original data/pause sequence.

13. Method according to one of the claims 1 through 12, characterized in that the control means (5) of the base station assures that each mobile telephone can transmit at least once in a time interval that corresponds to the size of its transmission data memory (15).

14. Method according to one of the claims 1 through 13, characterized in that, dependent on the data stored in the transmission data memories (3, 15) of the base station and of the mobile parts, the base station informs respective mobile parts whether the mobile part sends and/or receives data for a specific time duration.

15. base station for a compressed cordless communication with a plurality K of base stations via a plurality K*<K of physical radio channels, comprising:

-- a data input;
-- a data pause acquisition means (1) for acquiring data pauses in the transmission data;
-- a transmission data memory (3) for storing the transmission data;
-- a transmission time reference memory (6) for storing transmission data and transmission pause time reference information;
-- a modulator/concentrator (8) for compressing the transmission data onto K* physical radio channels;
-- a transmission means (10);
-- a reception means (11);
-- a demodulator/expander (9) for expanding the received data onto K logical communication channels;
-- a reception data memory (4) for storing the reception data;
-- a reception time reference memory (7) for storing the time reference information belonging to the received data;
-- a data output;

-- a control means (5) for controlling the transmission time intervals of the transmission means (10) and of the mobile parts and for compiling the reception data stored in the reception data memory (4)on the basis of the time reference information stored in the reception time reference memory (7) such that the original data/pause sequence of the data is restored for the output of the data at the data output.

16. Base station according to claim 15, characterized in that the data output is connected to another communication network.

17. Mobile part for a compressed cordless communication with a base station, comprising:

-- a data input;

-- a data pause acquisition means (20) for acquiring data pauses in transmission data;

-- a transmission data memory (15) for storing the transmission data;

-- a transmission time reference memory (17) for storing the appertaining transmission data and transmission pause time information;

-- a transmission means (13);

-- a reception means (12);

-- a reception data memory (14) for storing the reception data;

-- a reception time reference memory (16) for storing the time reference information belonging to the received data;

-- a data output;

-- a control means (18) for controlling the transmission time means (13) for the transmission of transmission data dependent on the transmission time intervals received from the base station and for compiling the reception data stored in the reception data memory (14)on the basis of the time reference information stored in the reception time reference memory (16) such that the original data/pause sequence of the data is restored, and for the output of the data at the data output.

Abstract

Method for the Compressed Cordless Communication Between a Base Station and a Plurality of Mobile Parts

Method for the compressed cordless communication between a base station and a plurality K of mobile parts via a plurality of K*<K physical radio channels comprises the method steps:

-- acquisition of pause sections in the respective transmission data in the base station and the mobile parts;

-- storing the transmission data in a transmission data memory (3, 15) in the base station and in the mobile parts;

-- storing the appertaining transmission data and transmission pause time reference information in a transmission time reference memory (6, 17) in the base station and in the mobile parts;

-- communicating the time reference information from the mobile parts to the base station;

-- determining transmission time intervals of the base station and of the mobile parts with a control means (5) implemented in the base station;

-- transmitting the transmission time intervals allocated to the individual base stations from the base station to the respective mobile parts

Figure 1.

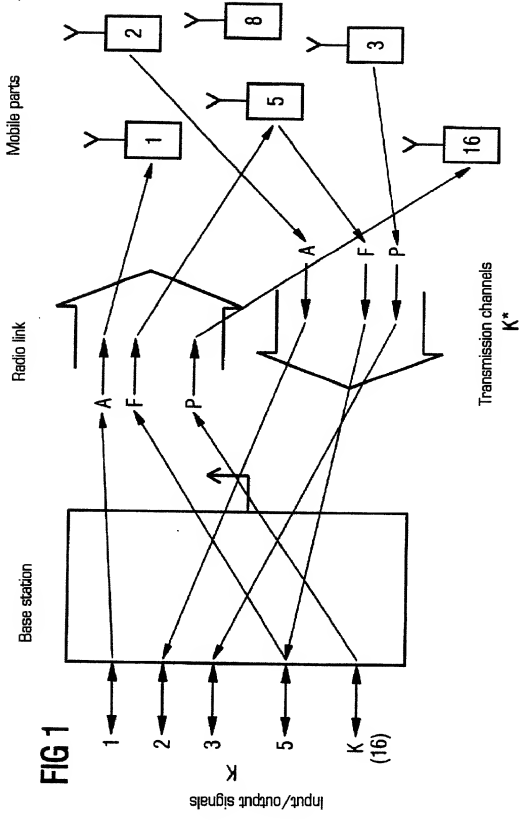


FIG 1

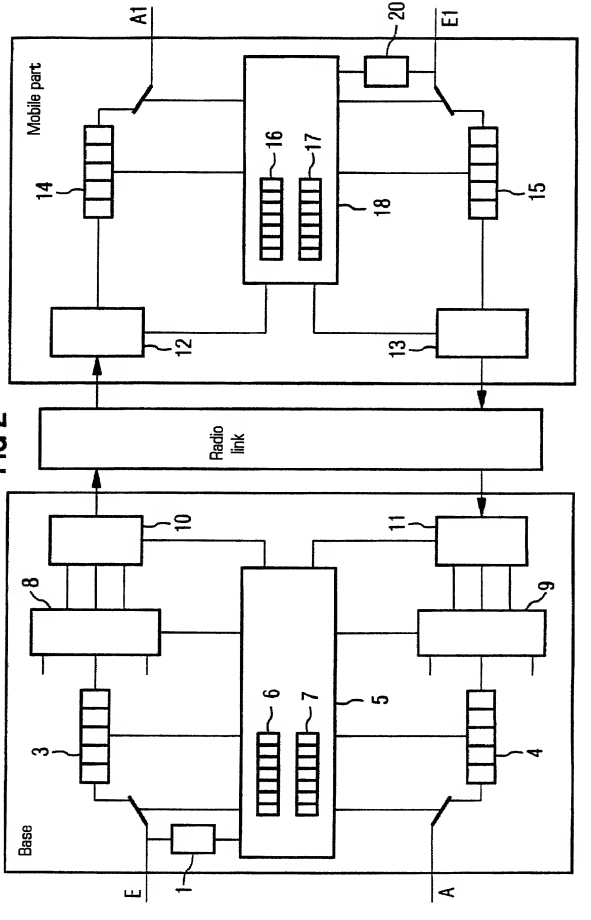


FIG 2

FIG 3A

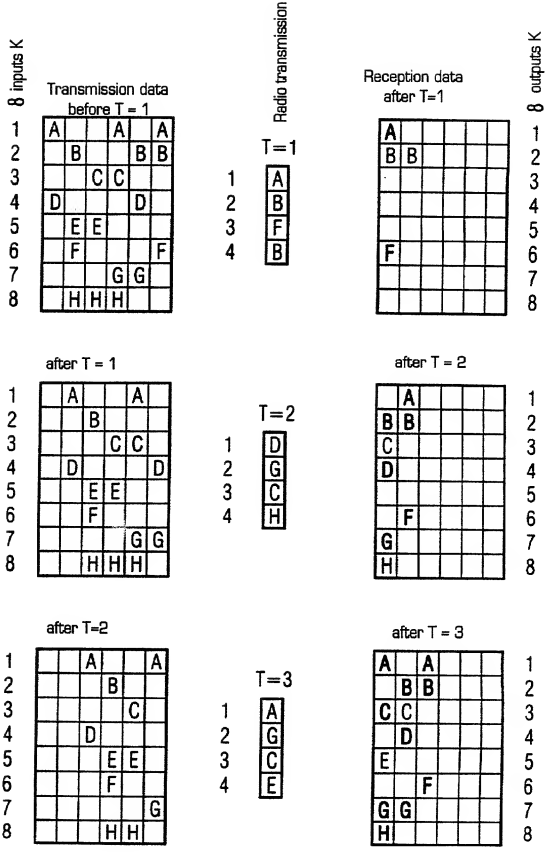
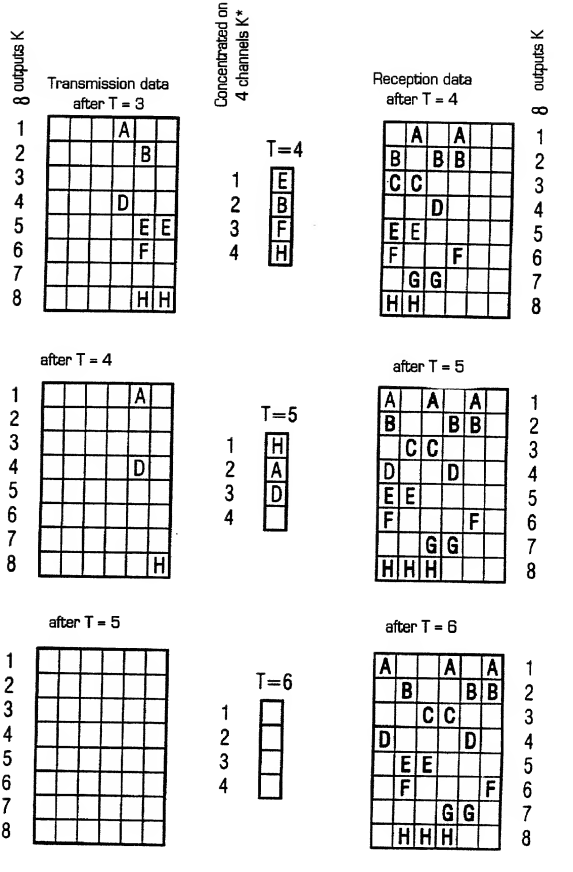

8 inputs K
Transmission data
before T = 1
Radio transmission
T=1
Reception data
after T=1
8 outputs K
after T = 1
T=2
after T = 2
after T=2
T=3
after T = 3

FIG 3B


8 outputs K
Transmission data
after T = 3
Concentrated on
4 channels K*
T=4
Reception data
after T = 4
8 outputs K
after T = 4
T=5
after T = 5
after T = 5
T=6
after T = 6

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

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My residence, post office address and citizenship are as stated below next to my name,

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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zur komprimierten schnurlosen Kommunikation zwischen einer Basisstation und einer Mehrzahl von Mobilteilen

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

(check one)

☐ is attached hereto.

☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

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I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

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Form PTO-FB-240 (8-83) Patent and Trademark Office-U.S. DEPARTMENT OF COMMERCE

German Language Declaration

Prior foreign applications
Priorität beansprucht

(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Priority Claimed Yes Ja	No Nein
198 25 076.2	Germany	04. Juni 1998	☒	☐
			☐	☐
			☐	☐

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der fruheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

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German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

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(Supply similar information and signature for third and subsequent joint inventors).